

CIA5

dimethylsulfoxide, butyl acetate, acetic acid, ethylhexanoic acid, methane, ethane, pyridine, and PF₃.

C1

29. (Amended) The method of Claim 28 wherein said co-reactant is a reducing agent selected from the group consisting of hydrogen, forming gas, silane, and combinations thereof.

A
A6

30. (Amended) The method of Claim 28 wherein said co-reactant is an oxidizing agent selected from the group consisting of oxygen, ozone, water, hydrogen peroxide, nitrous oxide, and combinations thereof.

31. (Amended) The method of Claim 28 wherein said co-reactant is a nitriding agent selected from the group consisting of ammonia, hydrazine, hydrogen azide, tertbutylamine, isopropylamine, and combinations thereof.

32. (Amended) The method of Claim 28 wherein said co-reactant is a silyating agent selected from the group consisting of silane, disilanes, chlorosilanes, silylamines, silazanes, and combinations thereof.

C1
AM

45. (Amended) The method of Claim 41 wherein the conductive barrier is selected from the group consisting of TaN, TaSiN, TiAlN, TiSiN, TaWN, TiWN, NbN, ZrN, TaTiN, IrO_x, Os, OsO_x, MoSi, TiSi, ReO₂, and doped or undoped alloys, mixtures and multilayers thereof.

REMARKS

Favorable reconsideration and allowance of the claims of the present application are respectfully requested.

In the present Office Action, Claims 18, 20 and 45 are objected to because of the informalities listed at Page 2 of the Office Action. In response to the formal objection,

applicants have amended Claims 18 and 20 by replacing the term "tetrahydroguran" with "tetrahydrofuran". Support for this amendment to Claims 18 and 20 is found at Page 21, line 10 of the specification of the instant application. Insofar as Claim 45 is concerned, applicants have deleted the redundant compounds listed therein.

In view of the above amendments and remarks, the formal grounds of objection to Claims 18, 20 and 45 have been obviated. Reconsideration and withdrawal of the formal grounds of objection are thus respectfully requested.

Claims 1-3 and 13-56 stand rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Specifically, Claims 1, 13, 23 and 29-32 are rejected for the reasons mentioned at Pages 2-4 of the Office Action.

In response to the rejection under 35 U.S.C. §112, second paragraph, applicants have canceled Claim 23, without prejudice or disclaimer; deleted the term "optional" from Claim 1; identified the type of compound which is being selected from Claim 28 in each of Claims 29-32; and deleted the term "aryl" from Claim 13.

The above amendments to the claims obviate the rejection under 35 U.S.C. §112, second paragraph; therefore applicants respectfully request reconsideration and withdrawal of the instant §112 rejection.

In addition to the above amendments, applicants have also amended Claims 1, 3 and 13 by deleting alkyl, alkenyl, alkyne, cycloalkenyl, aryl and alkoxy as possible choices for the ligands R¹ and R², and by deleting alkene, alkyne and cycloalkene as possible choices for the ligand A. The removal of these 'organic ligands' from the claims was done to overcome the prior art rejections mentioned in the present Office Action.

Since the above amendments to the claims do not introduce any new matter into the application, entry thereof is respectfully requested. As required by 37 C.F.R. §1.121, applicants have attached a marked-up version of the changes made to the claims by the current amendment. The marked-up attachment is captioned "VERSION WITH MARKINGS SHOWING CHANGES MADE".

Claims 1-3, 14-15 and 23-24 stand rejected under 35 U.S.C. §102(b) as allegedly anticipated by U.S. Patent No. 5,820,664 to Gardiner, et al. ("Gardiner, et al."). Claims 1-3, 14-15, 23-24 and 49-52 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over the combined disclosures of Gardiner, et al. and U.S. Patent No. 5,998,870 to Lee, et al. ("Lee, et al.")

Claims 1-3 and 13-24 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over U.S. Patent No. 6,214,105 to Hintermaier, et al. ("Hintermaier, et al."). Claims 25-43 and 47 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over the combination of Hintermaier, et al. and U.S. Patent No. 5,879,459 to Gadgil, et al. ("Gadgil, et al."). Claims 43-48 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over the combination of Hintermaier, et al., Gadgil, et al., and U.S. Patent No. 5,382,817 to Kashihara, et al. ("Kashihara, et al."). Claims 53-56 stand rejected under 35 U.S.C. §103 as allegedly unpatentable over the combined disclosures of Hintermaier, et al., Gadgil, et al. and U.S. Patent No. 6,067,244 to Ma, et al. ("Ma, et al.").

Turning to the §102 rejection, it is axiomatic that anticipation under §102 requires that the prior art reference disclose every element of the claim to which it is applied. In re King, 801 F.2d 1324, 1326, 231 USPQ 36, 138 (Fed. Cir. 1986). Thus, there must be no differences between the subject matter of the claims and the disclosure of the applied prior art reference.

Stated in another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of this rule is equally applicable. The absence from the applied reference of any claimed element negates anticipation. Kolster Speedsteel AB v. Crucible Inc., 793, F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986).

Applicants respectfully submit that Claims 1-3, 14-15 and 23-34 are not anticipated by the disclosure of Gardiner, et al. since the prior art reference does not disclose applicants' claimed precursor compound recited in amended Claim 1. Specifically, Gardiner, et al. do not disclose a precursor compound having the ligands presently recited in amended Claim 1. In contrast, Gardiner, et al. disclose a precursor compound which must include an organic ligand selected from the group consisting of β -diketonates, β -ketoimimates, β -ketodiimimates, C₁₋₈ alkyl, C₂₋₁₀ alkenyl, C₂₋₁₅ cycloalkenyl, C₆₋₁₀ aryl, C₁₋₈ alkoxy, and fluorinated derivates thereof. None of these required organic ligands are presently recited in amended Claim 1 as a possible choice for the ligands R¹, R² and A. As such, the claims of the present application are not anticipated by the disclosure of Gardiner, et al.

The foregoing remarks clearly establish that Gardiner, et al. do not teach every aspect of the claims, as required by King and Kolster Speedsteel; therefore the claims of the present application, as amended herein, are not anticipated by the applied reference. Applicants thus submit that the since the instant §102 rejection has been obviated, the rejection to the claims citing Gardiner, et al. can and should be withdrawn.

Insofar as the §103 rejection to Claims 1-3, 14-15, 23-24 and 49-52 citing the combination of Gardiner, et al. and Lee, et al. is concerned, applicants submit that this combination of applied references does not render applicants' claims unpatentable since the applied references do not teach or suggest the use of one of applicants' claimed precursor

compounds. Specifically, neither Gardiner, et al. nor Lee, et al. teach or suggest a precursor compound of the formula $MR^1_xR^2_yA_z$ wherein R^1 , R^2 , and A are as defined in amended Claim 1.

Gardiner, et al. disclose a precursor compound that includes at least one organic ligand selected from the group consisting of β -diketonates, β -ketoiminates, β -ketodiiminates, C_{1-8} alkyl, C_{2-10} alkenyl, C_{2-15} cycloalkenyl, C_{6-10} aryl, C_{1-8} alkoxy, and fluorinated derivates thereof. The organic ligands of the prior art precursor compounds are not within the scope of the ligands presently recited for R^1 , R^2 , and A in the amended claims. Applicants find no motivation in Gardiner, et al. which would lead one to replace the prior art ligands with one of the presently claimed ligands. Indeed, Gardiner, et al. require that one of the aforementioned organic ligands must be present in the precursor compound.

Lee, et al. do not alleviate the defect in Gardiner, et al. since the applied secondary reference also calls for using organic precursor compounds such as triisobutyl Al or dimethyl Al hydride. See Col. 11, lines 32-35. As such, the combined disclosures of Gardiner, et al. and Lee, et al. would lead to the use of a precursor compound that includes an organic ligand such as β -diketonates, β -ketoiminates, β -ketodiiminates, C_{1-8} alkyl, C_{2-10} alkenyl, C_{2-15} cycloalkenyl, C_{6-10} aryl, C_{1-8} alkoxy, and fluorinated derivates thereof.

In view of the above amendments and remarks, the rejection to Claims 1-3, 14-15, 23-24 and 49-52 under 35 U.S.C. §103 citing the combined disclosures of Gardiner, et al. and Lee, et al. has been obviated. Reconsideration and withdrawal of the instant rejection are thus respectfully requested.

Insofar as the remaining 103 rejections are concerned, applicants submit that Hintermaier, et al. alone, or in combination with Gadgil, et al., Kashihara, et al., and/or Ma, et

al., do not render the claims obvious since none of the applied references teaches or suggests the use of the claimed precursor compound having the ligands presently recited in amended Claim 1.

Hintermaier, et al. disclose the use of organic metal precursors which include at least one ligand selected from the group consisting of a β -diketonate such as 2,2,6,6-tetramethyl-3,5-heptanedionate (thd), an alkoxide, an alkyl, and/or an aryl. The use of such organic ligands is outside the scope of the present claims.

Gadgil, et al., Kashihara, et al., and Ma, et al. are further removed from the claimed invention as is evidenced by the Examiner's reliance on those disclosures for disclosing a reactor capable of being used in a pulse mode (Gadgil, et al.); materials for a ferroelectric capacitor (Kashihara, et al.); and materials for a ferroelectric FET. None of the applied secondary references used in conjunction with Hintermaier, et al. disclose the use of applicants' presently claimed precursor compound which includes the ligands R¹, R² and A defined in Claim 1. Indeed, the applied secondary references fail to mention the use of liquid metal precursor compounds.

As such, Hintermaier, et al. alone; Hintermaier, et al. in combination with Gadgil, et al., Hintermaier, et al., in combination with Gadgil, et al. and Kashihara, et al. or Ma, et al. do not render applicants' claims unpatentable.

The §103 rejections also fails because there is no motivation in the applied references which suggests modifying the metal precursor compounds to include applicants' claimed ligands. This rejection is thus improper since the prior art does not suggest this drastic modification. The law requires that a prior art reference provide some teaching, suggestion, or motivation to make the modification obvious.

Here, there is no motivation provided in the disclosures of the applied prior art reference, or otherwise of record, which would lead one skilled in the art to make the modification mentioned hereinabove. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d, 1260, 1266, 23 USPQ 1780, 1783-84 (Fed. Cir. 1992).

There is no suggestion in the prior art of applicants' claimed metal precursor compound having the ligands R¹, R² and A recited in amended Claim 1 therefore all the claims of the present application are not obvious from the prior art applied in the present Office Action.

Based on the above amendments and remarks, each of the §103 rejection has been obviated; therefore reconsideration and withdrawal of the instant §103 rejections are respectfully requested.

Wherefore reconsideration and allowance of the claims of the present application are respectfully requested.

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Serial No.: 09/553,997

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(13322)

**ATTACHMENT: VERSION WITH MARKINGS SHOWING CHANGES MADE
IN THE CLAIMS:**

Please cancel Claim 23, without prejudice or disclaimer, and amend the following
claims to read as indicated below:

1. (Amended) A precursor source mixture comprising at least one precursor compound which is dissolved, emulsified or suspended in an inert liquid, said at least one precursor compound having the formula:



where M is an element selected from the group consisting of Li, Na, K, Rb, Cs, Fr, Be, Mg, Ti, Zr, Hf, Sc, Y, La, V, Nb, Ta, Cr, Mo, W, Mn, Re, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, B, Al, Ga, In, Tl, Si, Ge, Sn, Pb, As, P, Sb and Bi; R¹ and R² are the same or different ligands selected from the group consisting of hydride, [alkyl, alkenyl, cycloalkenyl, aryl, alkyne,] carbonyl, amido, imido, hydrazido, phosphido, nitrosyl, nitryl, nitrate, nitrile, halide, azide, [alkoxy,] siloxy, silyl, and halogenated, sulfonated or silylated derivatives thereof; A is a[n optional] coordinatively bound or associated ligand selected from the group consisting of phosphines, phosphites, amines, arsines, stibenes, ethers, sulfides, nitriles, isonitriles, [alkenes,] hydrazine, pyridines, nitrogen heterocycles, macrocycles, schiff bases, [cycloalkenes,] alcohols, phosphine oxides, alkylidenes, nitrites, [alkynes,] and water; x ≥ 1; x+y = the valence of element M; and z is ≥ 0.

3. (Amended) The precursor source mixture of Claim 1 wherein M is Li, Na, K, Rb, Cs, Fr, Be, Mg, Ti, Zr, Hf, Sc, Y, La, V, Nb, Ta, Cr, Mo, W, Mn, Re, Fe, Ru, Os, Co, Rh, Ir,

Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, B, Al, Ga, In, Tl, Si, Ge, Sn, Pb, As, P, Sb or Bi; R¹ is a hydride; R² is a hydride, [alkyl, alkenyl, cycloalkenyl, aryl, alkyne,] carbonyl, amido, imido, hydrazido, phosphido, nitrosyl, nitryl, nitrate, nitrile, halide, azide, [alkoxy,] siloxy, silyl, or halogenated, sulfonated or silylated derivatives thereof; and A is a phosphine, phosphite, [aryl,] amine, arsine, stibene, ether, sulfide, nitrile, isonitrile, [alkene, alkyne,] hydrazine, pyridine, nitrogen heterocycle, macrocycle, schiff base, [cycloalkene,] alcohol, phosphine oxide, alkylidene, nitrite or water.

13. (Amended) The precursor source mixture of Claim 1 wherein M is Pt; R¹ and R² are hydride, [alkyl, alkenyl, cycloalkenyl, aryl, alkyne,] carbonyl, amido, imido, hydrazido, phosphido, nitrosyl, nitryl, nitrate, nitrile, halide, azide, [alkoxy,] siloxy, silyl, or halogenated or sulfonated derivatives thereof; and A is a phosphine, phosphite, [aryl,] amine, arsine, stibene, ether, sulfide, nitrile, isonitrile, [alkene, alkyne,] hydrazine, pyridine, nitrogen heterocycle, macrocycle, schiff base, [cycloalkene,] alcohols, phosphine oxides, alkylidene, nitrites or water, with the proviso [s]that the compound is not (cyclopentadienyl)Pt(alkyl)₃.

18. (Amended) The precursor source mixture of Claim 16 wherein the additive is selected from the group consisting of methanol, ethanol, isopropanol, neopentanol, trimethylamine, dimethylethylamine, diethylmethylamine, triethylamine, dimethylamine, diethylamine, bistrimethylsilylamine, ammonia, ethylenediamine, propylenediamine, trimethylethylene diamine, triphenylphosphine, triethylphosphine, trimethylphosphine, allyl, cyclopentadiene, benzene, ethylbenzene, toluene, cyclohexadiene, cyclooctadiene, cycloheptatriene, cyclooctatetraene, mesitylene, [tetrahydroguran] tertahydrofuran, dimethylformamide, dimethylsulfoxide, butyl acetate, acetic acid, ethylhexanoic acid, methane, ethane, pyridine, and PF₃.

20. (Amended) The precursor source mixture of Claim 19 wherein the additive is selected from the group consisting of methanol, ethanol, isopropanol, neopentanol, trimethylamine, dimethylethylamine, diethylmethylamine, triethylamine, dimethylamine, diethylamine, bistrimethylsilylamine, ammonia, ethylenediamine, propylenediamine, trimethylethylethylenediamine, triphenylphosphine, triethylphosphine, trimethylphosphine, allyl, cyclopentadiene, benzene, ethylbenzene, toluene, cyclohexadiene, cyclooctadiene, cycloheptatriene, cyclooctatetraene, mesitylene, [tetrahydroguran] tetrahydrofuran, dimethylformamide, dimethylsulfoxide, butyl acetate, acetic acid, ethylhexanoic acid, methane, ethane, pyridine, and PF₃.

29. (Amended) The method of Claim 28 wherein said co-reactant is a reducing agent [is] selected from the group consisting of hydrogen, forming gas, silane, and combinations thereof.

30. (Amended) The method of Claim 28 wherein said co-reactant is an oxidizing agent [is] selected from the group consisting of oxygen, ozone, water, hydrogen peroxide, nitrous oxide, and combinations thereof.

31. (Amended) The method of Claim 28 wherein said co-reactant is a nitriding agent [is] selected from the group consisting of ammonia, hydrazine, hydrogen azide, tertbutylamine, isopropylamine, and combinations thereof.

32. (Amended) The method of Claim 28 wherein said co-reactant is a silyating agent [is] selected from the group consisting of silane, disilanes, chlorosilanes, silylamines, silazanes, and combinations thereof.

45. (Amended) The method of Claim 41 wherein the conductive barrier is selected from the group consisting of TaN, TaSiN, TiAlN, TiSiN, [TaSiN_x] TaWN, TiWN, [TaSiN_x]

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TaAlN, NbN, ZrN, TaTiN, [TiSiN, TiAlN] IrO_x, Os, OsO_x, MoSi, TiSi, ReO₂, and doped or undoped alloys, mixtures and multilayers thereof.